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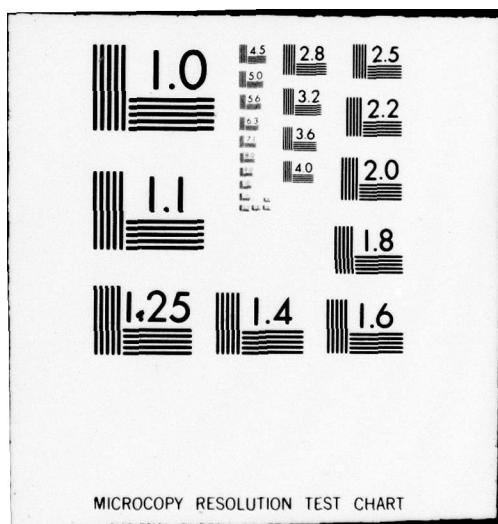
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NAVY PERSONNEL SUPPLY - REPORT OF A WORKSHOP HELD AT SPRINGFIELD--ETC(U)  
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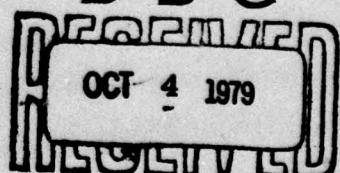
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Manpower Research and Advisory Services

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The report summarizes a two-day workshop, sponsored by the Office of Naval Research, that dealt with the supply of personnel to the Navy and Marine Corps. Deputy Assistant Secretaries of the Department of Defense and the Navy provided their perspectives. Seven formal presentations covered these areas: research and development on personnel supply models; population trends and their effects on labor market participation; how earnings and population co-vary; to relationship of recruiting resources to enlistments; (continued)		

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individual career choice; industrial human resources planning practices; the analysis of factors influencing naval personnel supply. Conclusions and recommendations coming out of small discussion groups are summarized.

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NAVAL PERSONNEL SUPPLY

*Report of a workshop  
held at  
Springfield, Virginia*

*May 7-8, 1979*

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September 1979

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States Government.

#### **ACKNOWLEDGEMENTS**

The workshop reported in this paper was planned and executed with the close cooperation of a number of people, and we want to gratefully acknowledge their help. Some served during the planning phase, some were discussants for the formal presentations, and some were discussion leaders at the meeting. Our thanks to: Jules Borack, Glenn Bryan, William Cralley, Alan Fechter, Joyce Ferris, Paul Hogan, Daniel Kuhn, Michael Letsky, Ron Liveris, Lee Mairs, Kneale Marshall, R. T. McDonald, William Osgood, Irwin Schiff, and Peter Van Winkle.

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**H. Wallace Sinaiko**

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## BACKGROUND

The supply of qualified men and women volunteers for the Navy and Marine Corps is being threatened by two phenomena: a) there is an absolute reduction in the prime age cohort (17-21) because birth rates declined in the 1960's; b) demand for entry level youth is increasing in non-military Federal programs, and industry and colleges continue to compete for their share of that group. The decline in numbers is expected to continue at least until 1990. Navy and Marine Corps recruiting have felt the effects of reduced supply; in a recent 36-month period the Navy has met its recruiting goals for non-prior-service males only 15% of the time.

Since 1976 the Office of Naval Research Manpower R&D Program has supported work dealing with the supply of personnel. The purpose of the research in that area has been to understand personnel supply so that planners can develop appropriate strategies for coping with it. ONR-supported researchers have dealt with econometric forecasting and its applications to naval manning; they have also investigated methods for predicting the influences of new technologies on future manpower needs. One research effort is looking into the sociological phenomenon of occupational inheritance (the tendency of children to enter the careers of their fathers) and whether it can be exploited in the face of the shortages mentioned earlier. There is also related work under way concerning the impact on accessions of advertising, recruiters, and unemployment.

Early in 1979 the ONR program manager asked that a meeting be organized to review the status of personnel supply modeling methods and, secondarily, to recommend candidate research areas for ONR support. A subcommittee of the ONR Manpower R&D Planning Committee laid out an agenda, identified and invited speakers, and organized a workshop. Attendance was limited in order to encourage interchange among the participants. The meeting format was as follows: In an opening session officers from the Navy and Marine Corps highlighted their Services' respective personnel supply problems and their interests in being able to forecast supply. High level manpower policy planners—deputy assistant secretaries from the Departments of Defense and the Navy—explained their use of and need for research in personnel supply matters. The main part of the meeting was given to speakers from academic, industrial, and in-house organizations who discussed their own work and what they saw as

opportunities for further research. Time was set aside during the meeting for subgroups of participants to discuss in depth the issues raised in the formal presentations.

This report summarizes the workshop. It includes summaries of the remarks of the keynoters (representatives of the secretariats and the Navy and Marine Corps) and abstracts of formal papers. Issues that are attractive candidates for research support are described in the final section. An appendix contains the meeting's agenda and data tables of one of the speakers. Names of workshop attendees comprise the first section of the distribution list.

The workshop was held in Springfield, Virginia, during May 7-8, 1979.

#### THE MEETING

##### Keynoters

As indicated, there were four speakers in the opening session. CDR H. A. Levien, representing the Navy Recruiting Command and serving as chairman of the workshop, reviewed the state of Navy recruiting. In general, the Navy is not getting the numbers or quality of people it requires and has failed to meet its recruiting goals in recent years. While quotas for females, reserves, and officers have been satisfied for the most part, those for the largest category of recruits—non-prior-service males—have not. Quality requirements currently dictate that 76% of all non-prior-service male recruits be high school diploma graduates and that 83% be "school eligible," i.e., able to meet school entrance criteria. Added to supply problems is the fact that the productivity of the recruiting force has dropped since 1977; e.g., the recruiting force average productivity is down 38% from the October 1977 level. The Navy Recruiting Command is supporting research through the Office of Naval Research and the Office of the Secretary of Defense in an attempt to improve overall production and reverse the current trend. Such issues as the relative merits of recruiter strength vs. advertising, factors affecting competition both with the other Services and private enterprise, factors affecting youth decision processes in pursuit of life goals, improved geographical distribution of recruiting assets, etc., are included in the current research efforts. The challenge remains to recruit the quality and quantity of youth needed to man the Navy. The Navy has a continuing need for research to address the following issues:

1. How many youths can the Navy expect to recruit?
2. How many youths can the Navy afford?
3. How many youths does the Navy really want?

The second speaker was LCOL W. H. Osgood, who discussed personnel supply problems in his service. There is an increasing demand for high quality personnel due to a shift toward the incorporation of increasingly

complex equipment in Marine Corps operations. A complicating factor is that it is difficult to anticipate manpower needs for new systems; i.e., there is no effective methodology for deciding how many and what types of people will be required. Illustrating current shortages, Colonel Osgood said that manpower for the tactical data system specialty is at 25% of desired strength; furthermore, the Marines anticipate a fivefold increase in the need for trained people in that occupational field. The Marines have traditionally been a "first term intensive" service. The emphasis on sophisticated equipment, however, will change this. Colonel Osgood also expressed the interest of his service in techniques for the effective allocation of such recruiting resources as advertising and recruiters.

Following Colonel Osgood, Dr. Gary Nelson, Deputy Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), discussed the long term prospect for military manpower. He pointed out that in order for the volunteer force to have a good chance for success, the Gates Commission in 1969 recommended two major changes: a) large pay increases for first term enlistees and b) intensified and more professional recruiting activities. Such measures, Nelson said, proved adequate through 1977. With changing demographics, however—particularly a decline in the number of 17-year-olds, which began in 1978 and is anticipated to continue through the 1980's—it has become necessary to evolve new manning strategies. Primarily, the Department of Defense is working toward ways of reducing its dependence on male, non-prior-service, high school graduates. This can be done in several ways: by lowering the attrition rate among first term enlistees, by seeking and expanding new sources of manpower (primarily women), and by working toward the increased retention of first-termers through higher reenlistment rates.

One of the reasons for the Services' inability to meet their demands for quality manpower has been the sharp increase in the complexity of weapons coming into their inventories. Nelson advocated a "black box replacement" method of maintenance which would shift the burden of fault diagnosis and repair from the uniformed force to rear echelon civilian technicians. The Services must face up to the necessity of accommodating to the short-tenure, high-turnover character of most of their accessions.

Recent recruiting has been unsuccessful in meeting goals for high school diploma graduates. The problem of shortages in that category was masked by relatively low goals in FY 78; but with higher quotas in FY 79 as well as higher quality standards, the Services have not been achieving their goals. Nelson cited several reasons for this poor recruiting performance: a) a replacement for the GI Bill, the VEAP program, is not seen as adequate; b) new Federal youth programs, e.g., CETA training and HEW scholarships, are competing for the military's prime market; c) unemployment rates are low (but may be reversing soon); d) military compensation has declined relative to civilian wages; e) there have been changes in tastes or propensities to enlist (a factor that Nelson discounts).

Nelson discussed research needs. He felt that current theories of personnel supply are overly simplistic with their emphases on youth

unemployment and seasonal factors. He called for new models that would take account of the process by which high school graduates make job decisions. Nelson also spoke of the complexities of demographics: for example, the number of youth is declining but the total labor force is increasing; and he called for work in understanding these phenomena. He added that the major competition for young entrants into the labor market might be government programs of the type mentioned above, rather than private industry; and he cited new aggressive recruiting tactics being mounted by colleges in the face of declining enrollments. Nelson concluded on the note that the demand for youth by private employers might decline as the labor force ages and more mature and attractive workers become available. Nelson speculated that, with minimum wages ever increasing, young workers might be perceived as less desirable and hence be drawn back toward military enlistment.

The fourth keynoter was Dr. Bernard Rostker, Principal Deputy Assistant Secretary of the Navy (Manpower and Reserve Affairs), who discussed the supply of personnel to the Navy. He stressed the need to "come to grips with the realities of the market place"— which, in his view, include far more than econometric factors. Rostker said that there is a need to explore and understand shifts in the supply curve, not just simple movements along it. He pointed out that wages are eroding and that military compensation needs reform: the new OSD compensation plan is not projecting an attractive option in relation to other alternatives.

Rostker called for macro-level research dealing with the entire recruiting process, e.g., advertising appeals, recruiter strength, etc. He would like to be able to provide guidelines or techniques that would enable recruiting district commanders to handle their resources according to highly localized needs assessments. So far, very little attention has been given to that type of requirement. Rostker said that Navy "recruit goaling models" do not take into account resource allocation beyond a simple proportional relationship to population figures.

Rostker discussed some specific qualitative aspects of sub-populations of interest to the Navy. While demand for a declining number of youth is increasing, in the Navy and elsewhere, the Navy is not willing to lower its quality standards. There is current interest in adhering to a "parity policy" with respect to minority personnel, but careful attention has to be paid to avoiding an imbalance in the quality of minority accessions; i.e., too much unskilled labor in that group could lead to racial disturbances like those of 1972. Rostker also spoke of the planned increase in the number of Navy women: from about 5,000 in the mid-70's to 40,000 in 1983. There are some unanswered questions about the extent to which women will accept non-traditional jobs and perform well in them. Five non-combatant ships now have women crew members, and the number is to increase to about 60. Rostker said that it has been difficult to meet quotas for enlisted women in seagoing billets through volunteer procedures. Questions remain regarding the recruiting of women for ship assignments and the willingness of women to say in those jobs, he said.

Rostker discussed the dynamics of local labor markets. He said there are wide variations, and he proposed analytic research at the level of zip code units. At present, local recruiting commanders get very little guidance on how to target their activities; most tactics are worked out on a trial-and-error basis. Rostker described barriers to recruiting, such as communities that exclude military recruiters from schools and state employment agencies that do not credit placements of people in the military. He called for the development of "real time response" techniques in recruiting, saying that present methods are largely insensitive to changing local conditions. Rostker felt that advertising can be more responsive, and he argued for improved management of recruiters, perhaps through production bonuses.

Discussing the possibility of a return to a draft, Rostker said that major problems of high attrition and low retention rates would not change and, with such a return, might well increase. To combat high attrition he suggested stronger punitive measures. He also suggested the application of much more effort to increasing retention; if successful, this would greatly reduce pressures on recruiting. Rostker said that the Navy is currently about 20,000 petty officers under desired strength. He proposed changes in pay, working conditions, and factors impacting on job satisfaction as means of increasing petty officer retention rates.

In answering questions about new research directions, Rostker suggested the following: a) work on attitude change vis-a-vis military service and the Navy; b) an anthropological or sociological analysis of labor markets, especially to understand what has happened to the Class of '78 (its employment history, etc.). Rostker emphasized our lack of information about what military service does to people, i.e., institutional effects on performance, attitudes, etc.

#### Presentations

There were seven formal presentations during the meeting. This section contains an abstract of each paper.\* David Grissmer, the Rand Corporation, reviewed the recent history of research leading to the development of personnel supply models; he proposed some new directions that such models might take in the future. Michael Wachter, University of Pennsylvania, presented data on population trends in the U.S., information about how they affect labor market participation, and some projections for the next 15 years. Finis Welch, UCLA, discussed the relationship of cohort size to earnings, i.e., covariation in population and wage rates. Lawrence Goldberg, Center for Naval Analyses, spoke on requirements for Navy recruiting, i.e., numbers of recruiters and advertising budgets necessary to meet enlistment goals. Thomas Saving, Texas A&M, presented a life cycle model of individual career choice, and he showed how that theory explained enlistment behavior. Saving's model also used length of service as a major explanatory variable, and he showed how personnel policies impact on turnover. James Sheridan, AT&T,

\* In every case but one (the abstract of David Grissmer's paper), these summaries were written by the speakers.

described human resources planning in the Bell System. Richard Grinold, University of California, Berkeley, discussed some of the factors influencing naval personnel supply and a point of view for analyzing them. Abstracts follow.

Experiments, Surveys, and Projections from Models - David Grissmer, the Rand Corporation. Early (pre-1971) research on military manpower concentrated on pay policy and factors likely to affect the numbers of volunteers in a no-draft condition; at that time little was known about which volunteers were draft-motivated and which were true volunteers. During the early years of the volunteer force, policy studies shifted toward consideration of personnel quality issues, e.g., the effects of enlistment incentives and unemployment on the supply of high caliber people. Models in use at that time tended to be simplistic, and they were unduly sensitive to short term effects such as seasonal phenomena.

Current supply forecasting models are generally useless for long-range predictions. They also tend to omit many variables, e.g., changes in college attendance opportunities. The models are useful, however, in that they can provide reasonable estimates of pay and unemployment effects on enlistment. Today's supply models are useful in giving short range early warnings, as they did for a recent decline in enlistments. Among the shortcomings of military manpower supply models are: a) they lack a basis in a comprehensive theory of enlistment supply; b) they do not explain why individuals fail to join the Services; c) they do not contain longitudinal data on youth; d) they ignore the reserve problem; e) they are not grounded in the results of controlled experimentation.

Some directions that manpower models of the 1980's should take are: a) they should provide supply forecasts early enough to permit the Department of Defense to adjust its plans accordingly; b) they should provide a means for evaluating the effects on enlistment of new benefits programs. There should also be research in such areas as development of a theory of youth labor markets, understanding of the nature of career decisions, and the disaggregation of economic data to local levels, perhaps going as fine-grain as zip code areas.

There have been several research efforts aimed at understanding the supply of military manpower. Since 1971 a number of surveys have been conducted at Armed Forces Examining and Enlistment Stations (AFEES). Unfortunately, successive surveys have been inconsistent in terms of questions asked and little trend information is available.

Under Department of Labor sponsorship, Ohio State University has conducted a "national longitudinal survey of youth" since the late '60's. Until this year, however, no people entering the military were tracked. The 1979 sample—6000 men and 6000 women, aged 14-21—will be followed for five years; data will become available in 1980 and succeeding years regarding employment experiences, including military enlistment and post-service jobs. (DOD and the separate Services are funding part of the survey.) There is a current experiment on new two-year enlistment options in the

Army, Navy, and Marine Corps. Expanded educational benefits are being used in some experimental conditions as a means of increasing personnel supply and redistributing occupational specialties.

Discussion.\* With regard to optimal forecasting intervals the speaker said that two to four years' lead time would be essential for most policy makers and that it is unlikely that as much as 8-10 year forecasts would ever be feasible. There was discussion on how little is known about people who apply to recruiters for information but do not actually take further steps to join the Navy.

There was some concern that, while pay may be highly significant in determining whether or not an individual enlists, it is not a manipulable condition and that researchers and analysts therefore tend to turn to less important variables such as advertising resources. Other benefits and inducements, such as the modified GI Bill (VEAP) were discussed and their merits debated; it is not clear, for example, whether some of these incentives help or hurt enlistment and retention.

Advertising and recruiter strength have generally been highly correlated with one another. That is, these resources have been covaried to the extent that it has not been possible to separate their independent effects.

The Available National Labor Supply Pool, 1979-1985 - Michael L. Wachter, University of Pennsylvania. (Abstract) Many of the significant labor market and related problems that we have today are due, at least in part, to the sharp swings in the fertility rate that the United States has experienced over the past forty years. The population structure of the U.S. today is a reflection of three dramatic shifts in the fertility rate. The first major change occurred with the Great Depression. At that time the total fertility rate declined sharply to 2.1 and the total number of births averaged 2.5 million. (A total fertility rate of 2.1 means that the average family has a completed family size of 2.1 children.) The second major shift was the baby boom of the late 1940's and early 50's. At the peak of the baby boom in 1957, completed family size had about doubled from Depression lows to 3.8 children per family with the total number of births at over 4 million per year. The baby boom peaked in 1957, remained at a high level through 1962 and then began a dramatic decline that continued through 1978. As of last year the total fertility rate was approximately 1.8 and the total number of births had declined to a total of 3.1 million per year. As a result of these fluctuations, the United States labor market is in severe imbalance.

Over the next decade, the baby bust cohort will begin to replace the baby boom cohort in the youth segment of the population. This will have major benefits and costs for the United States. The largest negative effects will impact those employers who traditionally hire from the pool of young workers.

\* This section, like others following some of the abstracts, summarizes the main issues and questions raised after the formal presentation.

The model utilized to forecast these developments is the "cohort overcrowding" or "relative income model." Essentially, a large birth rate in generation  $t$  yields an overcrowding of the labor market for the young workers in generation  $t+1$ . The result is a reduction in relative wages for these groups and, as a consequence, a decrease in fertility and an increase in labor force participation of secondary workers. The decline in fertility in  $t+1$  again generates a small cohort of younger workers in  $t+2$ . The shortage of young workers leads to an increase in their relative wages. In response to their favorable position, the labor force participation rates of the younger workers decline as fertility rates increase.

Over the past fifteen years the baby boom generation has resulted in an overcrowding of the youth labor market. The impact has indeed been a sharp reduction in their relative wages and fertility rates and an increase in their relative unemployment and labor force participation rates. The increase in participation and unemployment rates can thus be traced directly to the overcrowding population affect. In addition, this induced increase in the supply of workers only served to worsen the existing oversupply problems of younger workers.

Over the next fifteen years, the process will be reversed. The small size of the youth group will generate forces that magnify the reduction in the labor supply of young workers. Specifically, younger people will stay in school longer and some females will both start their families earlier and have a larger completed family size. That is, the participation rates of younger females will level off or grow at a much slower rate than is currently the case.

The shortage of workers in the entry level jobs will result in an increase in the relative wages of younger workers. This increase will reflect not only their favorable supply and demand conditions, but also an anticipated independent increase in the rate of productivity growth due to more rapid capital accumulation. The employers of younger workers will thus face an absolute and relative decline in their potential labor force. In addition, they will have to pay much higher absolute and relative wage rates to attract these workers. For unattractive skilled jobs, such as mining, wage rates are likely to skyrocket. For unattractive, lower skilled jobs, the problems will be even worse.

Adjustments to this situation are likely, but will also be very costly. Wherever possible, employers of younger workers are likely to attempt to recruit older workers. Many current skilled jobs that traditionally use male workers will need to attract more female workers. However, the slowdown in growth of younger female participation rates will end the current reserve of relatively low wage female workers. Finally, the flow of illegal aliens is likely to increase significantly. This group will help to staff the unskilled, less attractive jobs that would otherwise be priced out of existence.\*

\* Tables and figures accompanying Dr. Wachter's talk appear in Appendix B, pages 1-4.

Discussion. Implications for the Navy of these projected changes in the economy and the labor market are: a) demographic constraints will continue to worsen until the 1990's; b) unemployment rates for youngsters will be low and competition for the youth cohort will be strong; c) school enrollments will increase, causing further shrinkage of the labor force; d) the composition of the work force will change in the direction of greater heterogeneity, e.g., more black, female, and Hispanic participation.

Recognizing the coming reduction in the available labor force, the Navy can take some compensating actions, e.g., substitute older for younger workers (or naval enlistees). Or, as in industry, automation might be a substitute for some of the labor force. The Navy could at least identify differences between jobs that have to be performed by youngsters and those that can be handled by somewhat older people. Whatever solutions are tried, however, will be very expensive.

It is possible that so-called "inferior" occupations—those involving onerous or arduous tasks—will be filled only if their wages are increased; or that, as in the past, immigrants could be the only ones willing to take these jobs.

Apropos of the speaker's emphasis on long term trends, one commentator suggested that such variations are the most important for personnel supply planning, and he cautioned against overreacting to transient effects. In this regard he urged more work on developing policies that would recognize shifts in the age characteristics of the work force; for the Navy this could mean longer careers than the current 20 years, and it could mean more emphasis on lateral entry.

Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust - Finis R. Welch, University of California, Los Angeles. (Abstract)  
The job market arrival of the post-WWII baby boom cohorts raises many questions of effects associated with a rapid youthening of the labor force. This paper first summarizes 1967-1975 wage behavior showing that relative wages between schooling groups have not changed for prime age workers, but there is some evidence for new job market entrants that wages of more schooled workers have fallen relative to those with less. However, changes among schooling groups are small in comparison to those between new entrants and peak earners within schooling group. The evidence is very direct: as work-experience distributions shifted toward increased proportions of young workers, their relative wages fell.

After examining a career phase model in which workers at different phases are imperfect substitutes, estimates of empirical relationships between cohort size and wages are presented. The main result is that income depressant effects of (own) cohort size decline over the career but do not vanish altogether. Initial effects include reductions in wage rates and in hours and weeks worked while persistent effects extend only to wages.

The implications for Armed Forces recruitment are clear: all voluntary recruitment began in a period in which larger-than-average proportions of the population were young. This eased the recruitment problem both because of the large number of potential recruits and because the large numbers themselves increased competition for civilian jobs. Conversely, as numbers of potential recruits fall, as they will for the next 15 years, recruitment will become increasingly more costly.

Discussion. In dealing with wage fluctuations most economists look only at averages rather than wage dispersion. Very little is known about wage distributions and how they shift over time.

Recruiting Resource Requirements, FY 80-84 - Lawrence Goldberg, Center for Naval Analyses. (Abstract) Navy enlistments were about 10 percent less than goal in FY 78. Starting in 1980, population declines will reduce the supply of enlistments, yet future enlistment goals are not expected to decline much on the average. Therefore, the Navy is likely to have recruiting problems in the 1980's.

Our objective is the long-range planning of recruiting resources: that is, to estimate the recruiters and advertising expenditures required for the Navy to achieve its enlistment goals in fiscal years 1980-84. Such long-range planning requires that we estimate the supply of enlistments. This enables us to estimate future shortfalls and the resources required to eliminate them.

The supply of high school graduate enlistments to the Navy is estimated using quarterly time series data, 3Q71-4Q77. Besides recruiters and advertising expenditures, we also estimate the impact of quotas, unemployment, pay, and Navy policies on high school graduate enlistments.

Recruiters and advertising are about equally cost-effective in the long run in generating high school graduate enlistments. However, recruiters' effects are immediate while advertising's impact is mostly in future years; and unlike recruiters, advertising mostly affects high school graduates in the lower mental groups.

The results were used to forecast high school graduate enlistments and shortfalls, FY 80-85. Given proposed recruiting resource budgets, there will be high school graduate shortfalls averaging 8,600 per year, FY 80-84. Additional outlays on recruiters and advertising of about \$28 million per year would eliminate these shortfalls. Resource requirements would probably be minimized if about 65 percent of additional expenditures were allocated to recruiters and 35 percent to advertising.\*

Life Cycle Model of Military Manpower Problems - Thomas R. Saving, Texas A&M University. (Abstract) The traditional career choice theoretic approach to the military enlistment decision fails to account for the fact

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\* See Goldberg, L., "The Effects of Recruiters and Advertising on Navy Enlistments" (CNA 79-1365). Center for Naval Analyses, September 1979.

that the mean length of service is only slightly greater than the minimum term of enlistment. For the Air Force, the mean time from enlistment to separation has ranged from 4.5 to 5.2 years over the 1969-1976 period. Thus, the median enlistee treats the military not as a career but as a significant work experience in a working life cycle. A model of individual choice has been formalized in work by A. S. De Vany and myself which yields the optimal distribution of total working life between military and civilian alternatives. In this approach the typical individual has a planned working life that encompasses both military and civilian employment.

The theory has two important properties in explaining observed enlistment behavior. First, it makes the enlistment decision more than just a matter of comparing the present values of alternative career earnings. In fact, given that an individual has a positive desired level of military service, his enlistment decision depends on the relation between his desired length of stay and the minimum enlistment period. Any individual with a desired length of military service greater than the minimum will supply his services. Those individuals with desired lengths of military service less than the minimum enlistment must make an all-or-nothing decision between no military service and the minimum enlistment period.

The second important property of the theory is its ability to explain the mean length of military service. This aspect of the theory is important because of the crucial role played by the mean service time in the determination of the demand for enlistees. In fact, it is shown that the mean length of service is positively related to the military wage and negatively related to civilian wages and the probability of finding civilian employment. The greater the mean length of service, the smaller the flow of new enlistments required to maintain any given force level.

The military manpower inventory is jointly determined in two markets—the accession market and the retention market. A stochastic process model is developed which characterizes each of the markets. Viewing the allowable force as the number of servers in the process allows the mean length of service to be treated as the inverse of the service rate, i.e., one over the mean length of service is the expected number of times a particular position turns over in any given year. For the Air Force each position turns over approximately 0.2 times per year implying a five-year expected length of service.

The mean length of service, as pointed out above, is determined by military and civilian wages. The allowable force level, on the other hand, is mandated by Congress. These two factors together determine the military demand for enlistees. That is, the total number of positions times the number of times per year each position turns over yields the number of new enlistees that must be found if the force level is to be maintained.

On the supply side, i.e., the accession market, the rate at which new potential enlistees arrive is also a function of military and civilian

wages. Since losses from the existing force do not occur at a constant rate, but rather are randomly distributed around a fixed mean, the demand for replacements is also random. In a similar fashion, potential enlistees do not arrive in a constant stream but at a random rate.

These ideas have been utilized to derive the equilibrium level of accessions. This equilibrium level of accessions is not a supply curve of enlistees but is rather an equation describing the equilibrium of supply and demand. In effect the military tradeoff between wages, expected force level and quality can be developed. Importantly, the military can choose only two of these three crucial policy variables and the market determines the third. The military can fix wages and expected force level and then accept the resulting quality of personnel. On the other hand, the military can fix wages and quality and accept the resulting expected force level.

Significantly, certain changes in policy which adversely affect accessions and result in short run shortfalls might result in long run stable higher force levels. For example, a removal of the GI bill will reduce accessions but increase the mean length of stay, resulting in a lower turnover rate. In the new steady state the lower accession rate coupled with the lower turnover rate might maintain the desired manpower pool. In the short run, however, the manpower pool will fall since accessions will be less than the number required to maintain the pool until the new accessions proceed to the re-enlistment stage.

Integrated Human Resources Planning in the Bell System - James A. Sheridan, AT&T. (Abstract) Planning in the Bell System is integrated in that the financial, human resources, technology and environmental concerns are all considered by the teams of plan reviewers. Human Resources Planning actually plays a major role in the review of the financial analysis of the operating company 6-year plans. The Human Resources Department has a dedicated organization that deals with human resources planning. The planning process in the Human Resources Department utilizes a number of computer data bases, the largest being the personnel data base with over one million employee records stored in it, and sophisticated modeling capability. The standard techniques such as regression analysis and other statistical procedures are used to analyze data but are complemented with a Markov modeling system that allows for the analysis of employee flow between jobs. Such a system is useful in determining the transition between jobs and therefore can be used in a forecasting role.

The most significant development in modeling has been the development of a MACRO modeling system. This system is basically a workbench of discreet computer based models that can be combined in a variety of orders to address different problems. The workbench includes models that are internal to the business as well as external to the business. The basic role of the system is to analyze the impacts of environmental events on the business and in particular on the company's human resources. Environmental events such as a change in the inflation rate or the incursion of competition can be modeled to determine the impact on human resources requirements. These two examples are discussed in the

presentation. It is believed that many managers in the future will have such a system at their desk in a micro processor environment available to them at all times during the day. Such a system will provide the necessary "what if" answers to allow our managers to make better-informed decisions.

Discussion. Human resources planning in the Bell System is handled by a staff of about 50 people representing such professional disciplines as electrical engineering, law, economics, and operations research. Except for a small core group of about six, the planning staff rotates through from other divisions of the Bell System. Very few if any large industrial corporations do similar types of planning for their manpower needs.

Bell has experienced very long tenure among its blue collar force; operators and service representatives do have high turnover rates. The corporation has a "no layoff" policy, which means that departures are for voluntary reasons or cause. If a position becomes redundant, either through obsolescence or a business downturn, the company will retrain individuals or do what is necessary to keep them employed.

Bell has had considerable recent experience using women in non-traditional jobs. Turnover rates have been high, and the explanation centers on physical attributes of women, e.g., strength, stamina, body size, and metabolic rates.

May You Be with the Force - Richard Grinold, University of California, Berkeley. (Abstract) The Navy's supply of manpower is the number of people the Navy has in each of several categories, e.g., QM2 with six years of service, fighter pilot with four years of service, etc. This supply is influenced by a host of factors; the most significant of these are accessions policy, wages, promotion policy, tour lengths, and retirement policy. These policies deal with the raw material of the supply process and the possible combinations of the time and resources that will turn the raw material into a distribution of people by skill and experience that will meet the Navy's requirements for manpower.

The requirements are the demand for manpower. Demand is driven by the assigned mission of the Navy, the translation of that mission into platforms (ships, planes, and submarines), the support system needed to back up the platforms, and eventually the manpower by skill and experience needed to man the platforms and support system.

In this context supply policy should deal with both accessions and the system for transforming those accessions into a force with the desired distribution of skills and experience.

To analyze supply one should consider three factors: a) the opportunities available in the civilian labor market both for potential

accessions and for those currently in the force, b) the decision to participate based on perceptions of both the Navy's reward structure and civilian opportunities, and c) the dynamics of the supply process, which does not allow for a rapid change in the structure of the force.

The decision to participate can be modeled using a dynamic program. In any particular skill category one can calculate the expected present value (EPV) of staying in the force where that EPV considers both the current and future opportunities for leaving the force; for example, a new pilot would value the expected opportunity to move into a high paying civilian job after a sufficient amount of military experience. We postulate that a person's decision to remain in the service is a function of the difference between the EPV of remaining in the force and the EPV of the immediate civilian opportunity. That allows us to calculate the fraction of people in any one classification that leave to take civilian jobs. The outputs of this model are the distribution of people by classification, the continuation rates between classes, and the EPV of being in each class.

This type of analysis can be useful if it is used with imagination and a few grains of salt. Suppose we want a specified set of continuation rates for some type of naval aviators. Then we could use the model to see what types, if any, of promotion and reward structures can bring them about. This would allow us to relate classes of policies to classes of results and to test whether tinkering with the model's assumptions will alter the conclusions that one class of policies is related to one class of results. I believe it would be foolish to use such a model for numerical predictions; it is designed for policy analysis.

#### RECOMMENDATIONS FOR RESEARCH

This section summarizes proposals for research and analysis. These ideas were compiled from several sources, but primarily they came out of the intensive subgroup discussions held toward the end of each day.

##### Personnel Supply

Over the long run the area of modeling was seen as not very promising. But some felt that the exercise of existing models and the development of refinements to them would help the Navy compete for the diminishing numbers in the labor force. (The view was expressed that naval manpower planners require hard quantitative evidence to convince them of the realities of personnel shortages; supply modeling can provide that data.) On the other hand it was argued that modeling the Navy's demand for young entrants was an important research topic. A side of the supply picture that seems to be missing, and that would warrant investigation, is fine grain knowledge of local economic (i.e., employment) conditions and how they drive enlistments. The "micro-economic" analysis of local labor

markets could lead to the identification of small depressed areas with high recruitment potential. The implication of this would be a need for highly flexible recruiting services able to shift their responses and resources rapidly.

In addition to the type of personnel supply model that we have discussed—one which generates discrete numbers of people that can be anticipated—there is another kind of model. We are referring here to one which can be useful in assessing policy changes and how personnel supply may be influenced by them. The effects of new policies are, at best, difficult to analyze. What may be called for, at least as a first step, is the development of a personnel supply model that can provide qualitative or probabilistic statements that will assist managers in arriving at new policies in a rational way. For example, it would be useful to be able to know the range of effects of an admission standard that did not require U.S. citizenship. This second type of personnel model would, if it worked, make it possible to anticipate the marginal gains or losses resulting from an action.

A number of ideas were put forth regarding solutions to the inevitable shortages of young entrants into the labor market. All of these notions could be the subject of further research, although none of them surfaced for the first time at this meeting. First, it was proposed that the demand for personnel could be reduced through automation or less dependence on a labor-intensive system. There appear to be many unknowns here; but if the future supply picture is truly dismal, the Navy may be forced to shift to a capital-intensive state. Second, it was proposed that the Navy could, for many of its jobs, recruit somewhat older workers than the traditional 17-21 year group. Such an approach would require major organizational and management changes; e.g., it would make inoperable the assumptions of rotation and interchangeability. Long-held sea-shore rotation policies would have to give way to the reality of fewer people available for enlistment; research was seen as a way to explain why this is so and, possibly, what to do about it. Third, employment of more women was proposed; but, as a result of recently reported industrial experiences, the use of women in non-traditional tasks was seen as a difficult problem and not a simple solution to shortages. Furthermore, it was pointed out that more women in the Navy could mean longer at-sea tours for many men, a perturbation that could be counter-productive. Fourth, there may be opportunities for improving the supply picture through recruitment of more veterans, i.e., so-called "broken-service" personnel.

#### Recruiting

The recruiting process was seen as a candidate for change. The selection of recruiters, their training and assignment, and the ways they are rewarded were all cited. Productivity, reported in one of the papers as about twelve non-prior-service male high school graduate enlistments per year per recruiter, was felt to be shockingly low. One proposal called for a try-out of the Royal Navy's system of "careers officers," i.e., a virtually permanent recruiting force. (We are aware of a move in this

direction in the Navy Recruiting Command.) It was pointed out, however, that permanent recruiters are at a disadvantage in that: a) they may not have up-to-date knowledge of conditions in the operating Navy; b) they are not current in their previous ratings and therefore fail to advance; and, c) if they burn out as recruiters and return to fleet duty they may not be able to compete professionally with their peers. The development of new incentive systems for recruiters was proposed; they should include ways to reward the recruiter for bringing in successful recruits and discourage his accessioning people with high turnover prospects. (A move in this direction is also under way within the Navy.)

A side of recruiting that is only beginning to be understood, and one which deserves much more attention, is advertising and how it affects enlistments. Advertising is said to have long term influences, and advertising is believed to be differentially productive for different subsets of the target population. How, if at all, advertising affects the supply of personnel is largely unknown; but very large investments go into advertising, and its continued study is warranted. (A set-aside of 2% of the Navy's current recruitment advertising budget for R&D would provide modest but essential support at a level of about \$400K.)

An important influence on recruiting is the process by which youngsters decide to enter naval service. The act of committing four years or more of one's life, when the individual is likely to have had little or no work experience, is undoubtedly complex and filled with uncertainty. We need to know about the dynamics of this kind of commitment so recruiting can accommodate to it.

Questions were raised regarding recruiting operations: What is the optimum size of a recruiting station? Where should stations be located within districts? Are there differences among recruiters as to whether they do better in cities or in rural areas? What kind of marketing information is needed at the district and station level? How can "markets of opportunity" be exploited by local advertising? Can recruiters be assigned more effectively? Can they be brought up to speed sooner in their tours and kept productive longer? Questions were raised about the best that can be expected from the recruiting force, given the realities of supply constraints.

Proposals were made for testing the feasibility of using professional recruiting agencies. State employment agencies were also seen as untapped sources of applicants.

#### Supply-Limited Weapons

Workshop participants repeatedly expressed concerns that the weapon development process ignores the personnel supply problem. Because adequate numbers of qualified people were available in the past, weapon systems sponsors tend to assume that they will continue to be so in the future. But, as indicated repeatedly in this meeting and elsewhere, the assumption of a full pipeline is clearly not tenable: absolute numbers of 17-21 year olds are dropping, competition from other Federal programs is

increasing, and failure of career people to reenlist is unacceptably high. All of this suggests that personnel supply may become a determining factor in weapon system design. As has been the trend in other navies, e.g., that of the U.K., the U.S. Navy should anticipate having to do with fewer people and, perhaps, a diminution of quality. To put it another way, new design principles will be required to accommodate to the changes that are predicted. (The notion of "design-to-the-man" is neither new nor radical; in a sense, manpower availability has probably always been taken into account in the acquisition process.) A specific research question is the development of trade-off costs of equipment designed for different levels of manpower. Although the issue did not surface at the meeting, it should be pointed out that non-combatant activities, e.g., administration and support services, are labor intensive and that they, too, will have to be redesigned for much smaller numbers of people. (Some participants called for examination of the U.S.S.R. practice of providing extremely simple equipment because of the fact that 90% of the naval force enlistees serve only a single three year term.)

Human factors engineering can play a major role in this area by addressing such questions as: Can qualitative requirements be reduced by more reliable equipment? Can design change accommodate to a more heterogeneous, if smaller, work force (e.g., more women, older enlistees, etc.)? In the latter regard it was pointed out that there are pitfalls in the transition to a heterogeneous force; e.g., there are physical, psychological, and managerial factors that, in the case of women in non-traditional work, have to be taken into account.

Some participants felt that enlistment standards, such as the 76% high-school-diploma-graduate requirement, are arbitrary rather than truly reflective of Navy needs. Standards should be based on performance requirements, and the Navy Occupational Task Analysis Program (NOTAP) data base was said to be a good starting point. A related suggestion was that individuals' high school attendance rates might be better predictors of performance (or completion of tours) than possession of a diploma.

#### Other Manpower Issues

Retention refers to the Navy's being able to keep people beyond their initial terms of obligated service. At present there are serious shortages of petty officers in the second and third terms of enlistment. Although retention was not the subject of this meeting, it interacts with the requirement for non-prior-service males; and participants recommended that research into the nature of that interaction be done.

The question of productivity is very difficult to address, but it lies at the heart of the demand-supply relationship. We need new metrics for measuring or understanding the output of naval personnel so that realistic demand figures can be set.

A number of unconventional proposals for relieving the manning problem were put forth. One had to do with a "wet-dry" Navy, i.e., separately

recruited and managed seagoing and shore-based forces. Little is known about the numbers of people who would enlist in either type of Navy, for example. Another proposal dealt with much greater dependence on older (not aged) entrants. Related to this was a suggestion that "up-or-out" be eliminated or modified to permit some satisfactory performers not eligible for promotion to remain in service. In summary, some participants felt that many personnel policies grounded in tradition will have to give way to the realities of the 1980's and what might seem to be radical innovations. Agencies like the Office of Naval Research were singled out as needing to take a leading part in showing why such change is necessary and how it can be accomplished.

Personnel supply problems do not equally affect both arms of naval service. It was pointed out that the Marines, for example, have as many as one-third of their forces assigned overseas on unaccompanied tours at any time. The extent to which this policy affects the supply of first term applicants is not known; it is likely to be dissimilar for Navy people.

The larger issue of competition for youth was discussed. It was pointed out that very little is known about the nature of interservice competition, nor is there any quantitative evidence on college or industrial recruitment plans in the coming years. It was argued that quantitative personnel requirements are not enough—manpower planners have to be able to present to hardware planners the realities of what available recruits will or will not be able to do in specific work situations. (In this regard it was pointed out that the quality of Navy enlistees is, in fact, better now than it was 15 years ago if it is measured by the educational levels and high school completion records of new entrants.)

Lateral transfer—that is, the practice of adjusting to new work force demands by retraining and shifting personnel among technical specialties—is underexploited. Marine Corps participants said that their system permits a type of "negotiation" between the manpower system and individuals, with the desired result that some shortages are made up by lateral transfer out of ratings that are overmanned. The costs of lateral transfer should be estimated in terms of tradeoff against recruiting costs.

General questions were aired about manpower demand. The matter was stated simply as, "What do we need in the way of people to run the Navy?" The answer to such a question is, of course, complex—and, it was pointed out, must include consideration of Navy missions. The subject of demand involves both naval policy and changing technology. The objective of research here would be to develop techniques to enable planners to estimate how many and what types of people will be necessary in the future.

Finally, we want to emphasize the need for continued support of experimentation as a way of generating inputs to any personnel supply model. Neither the Navy nor the Marine Corps is a newcomer to field experiments—in fact, at least two major national experiments are in progress and a third is planned. Workshop participants were strongly in favor of empirical research that, they felt, would provide essential data for supply models.

**APPENDIX A - Agenda, Personnel Supply Workshop**

**APPENDIX B - Tables, Michael L. Wachter**

## APPENDIX A

### Office of Naval Research Personnel Supply Workshop

The Springfield Hilton  
Springfield, Virginia

7-8 May 1979  
9:00 a.m. - 4:30 p.m.

### AGENDA

#### May 7 - CDR H. A. Levien, Headquarters Navy Recruiting Command, Chairman

9:00 Opening session - Informal remarks on OSD and Navy perspectives on personnel supply  
Gary Nelson, Deputy ASD(MRA&L)  
Bernard Rostker, Principal Deputy ASN(M&RA)  
LCOL W. H. Osgood, Headquarters Marine Corps  
CDR H. A. Levien

10:30 "Experiments, Surveys, and Projections from Models" -  
David Grissmer, The Rand Corporation

11:30 Lunch break

1:00 "Effects of Cohort Size on Earnings" - Finis Welch, University of California (Los Angeles)

2:00 "The Available National Labor Supply Pool, 1979 through 1985" -  
Michael Wachter, Wharton Econometric Forecasting Associates

3:00 Discussion groups

4:30 Adjourn

#### May 8 - Robert Grafton, Office of Naval Research, Chairman

9:00 "Recruiting Resource Requirements, FY 80-84" - Lawrence Goldberg, Center for Naval Analyses

10:00 "Life Cycle Model of Military Manpower Problems" - Thomas Savings, Texas A&M University

11:00 "Human Resources Planning and Modeling in the Bell System" -  
James Sheridan, AT&T

12:00 Lunch break

1:00 "The Effect of Promotion, Retirement, and Wage Policies on Continuation Rates" - Richard Grinold, University of California (Berkeley)

2:00 Discussion groups

3:30 Wrap-up session

4:30 Adjourn

Table 1

CIVILIAN NONINSTITUTIONAL POPULATION

ESTIMATES AND PROJECTIONS

(Numbers in thousands)

<u>Age Group</u>	<u>1977</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
0 - 15	55,749	53,825	55,274	58,431
16 - 19	16,616	16,339	14,002	13,180
20 - 24	19,277	20,103	19,694	17,138
25 - 34	32,527	35,537	39,224	40,452
35 - 44	23,248	25,429	31,085	36,299
45 - 54	23,353	22,658	22,418	25,272
55 - 64	20,405	21,198	21,735	20,775
65+	23,430	24,927	27,305	29,823
<b>TOTAL</b>	<b>214,605</b>	<b>220,016</b>	<b>230,737</b>	<b>241,370</b>

See Wachter abstract, pp. 7-8.

Table 2

AGE STRUCTURE OF CIVILIAN NONINSTITUTIONAL POPULATION  
ESTIMATES AND PROJECTIONS

(Numbers are percentage of each age group over  
total civilian population)

<u>Age Group</u>	<u>1977</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
0 - 15	26.0	24.5	24.0	24.2
16 - 19	7.7	7.4	6.1	5.5
20 - 24	9.0	9.1	8.5	7.1
25 - 34	15.2	16.2	17.0	16.8
35 - 44	10.8	11.6	13.5	15.0
45 - 54	10.9	10.3	9.7	10.5
55 - 64	9.5	9.6	9.4	8.6
65+	10.9	11.3	11.8	12.3
<b>TOTAL</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

See Wachter abstract, pp. 7-8.

TABLE 3

NONINFLATIONARY RATE OF UNEMPLOYMENT, 1955, 1965, 1975 & 1977  
14 AGE-SEX GROUPS

	<u>1955</u>	<u>1965</u>	<u>1975</u>	<u>1977</u>
<b>Males</b>				
16-19	10.7	13.5	15.2	15.2
20-24	6.3	7.3	8.0	7.9
25-34	3.0	3.4	3.6	3.6
35-44	2.7	2.6	2.5	2.5
45-54	3.1	2.7	2.5	2.5
55-64	3.6	3.1	2.8	2.8
65+	3.6	3.6	3.6	3.6
<b>Females</b>				
16-19	9.8	13.8	16.7	16.6
20-24	5.6	7.6	9.0	8.9
25-34	4.7	5.7	6.2	6.2
35-44	3.8	4.3	4.7	4.6
45-54	3.3	3.5	3.7	3.7
55-64	3.3	3.2	3.1	3.1
65+	2.4	3.1	3.4	3.5

SOURCE: Michael L. Wachter, "The Demographic Impact on Unemployment: Past Experience and Outlook for the Future," Demographic Trends and Full Employment. A special report of the National Commission for Manpower Policy, Special Report No. 12, December 1976, pp. 27-99. The calculations have been updated to include data through 1977.

See Wachter abstract, pp. 7-8.

Table 4

PROJECTED GROWTH RATES OF CIVILIAN LABOR FORCE  
(in percent)

<u>Year</u>	<u>Wachter Projections</u>	<u>Unofficial BLS Projections</u>
1979	2.05	2.50
1980	1.81	2.36
1981	1.75	2.41
1982	1.60	2.18
1983	1.54	2.07
1984	1.46	1.97
1985	1.40	1.93

See Wachter abstract, pp. 7-8.

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